THE CLAIMS

What is claimed is:

1. A fluid storage and dispensing system for storage and dispensing a low vapor pressure fluid, comprising:

   a storage and dispensing vessel;

   a porous metal matrix disposed in said storage and dispensing vessel at an interior gas pressure, wherein said porous metal matrix comprises at least one Group VIII metal, Group IB metal ormetal alloy therof;

   a dispensing assembly coupled in gas flow communication with the storage and dispensing vessel, and arranged for dispensing fluid from said vessel.

2. The fluid storage and dispensing system of claim 1, wherein the low vapor pressure fluid to be stored and dispensed by said system comprises a fluid species selected from the group consisting of chlorine trifluoride (ClF_3), tungsten hexafluoride (WF_6), hydrogen fluoride (HF), germanium tetrafluoride (GeF_4), and bromine (Br_2).

3. The fluid storage and dispensing system of claim 1, wherein the porous metal metrix comprises one or more metals selected from the group consisting of iron, nickel, cobalt, ruthenium, rhodium, palladium, osmium, iridium, platinum, copper, silver, gold, and alloys thereof.

4. The fluid storage and dispensing system of claim 1, wherein the porous metal matrix comprises nickel.

5. The fluid storage and dispensing system of claim 1, wherein the porous metal matrix comprises stainless steel.

6. The fluid storage and dispensing system of claim 1, wherein the porous metal matrix forms a solid-phase metal adsorbent meterial and is characterized by an average pore diameter in a range of from about 0.5 nm to about 2.0 nm.

7. The fluid storage and dispensing system of claim 6, wherein the porous metal matrix is further characterized by a porosity in a range of from about 10% to about 30%, based on total volume of the porous metal matrix.

8. The fluid storage and dispensing system of claim 6, wherein the porous metal matrix is further characterized by a pore size distribution, wherein (1) from about 80% to about 90% of pores have a diameter in a range of from about 1.5 nm to about 2.0 nm, and (2) from about 10% to about 20% of pores have a diameter greater than 2.0 nm.

9. The fluid storage and dispensing system of claim 6, wherein the porous metal matrix further comprises non-metal adsorbent particles dispersed therein.

10. The fluid storage and dispensing system of claim 9, wherein the non-metal adsorbent particles comprises a material selected from the group consisting of zeolites, carbon materials, porous silicon, polymers, aluminum phosphosilicate, clays, and combinations of two or more species thereof.

11. The fluid storage and dispensing system of claim 9, wherein the non-metal adsorbent particles comprises a material selected from the group consisting of zeolites, carbon materials, and combinations thereof.

12. The fluid storage and dispensing system of claim 9, wherein the non-metal adsorbent particles have average pore size in a range of from about 0.5 nm to about 50.0 nm.

13. The fluid storage and dispensing system of claim 6, wherein the porous metal matrix further comprises non-metal adsorbent particles coated with a Group VIII metal, a Group IB metal or a metal alloy thereof.

14. The fluid storage and dispensing system of claim 13, wherein the non-metal adsorbent particles comprise a material selected from the group consisting of zeolites, carbon materials, porous silicon, polymers, aluminum phosphosilicate, clays, and combinations of two or more species thereof.

15. The fluid storage and dispensing system of claim 13, wherein the non-metal adsorbent particles comprise a material selected from the group consisting of zeolites, carbon materials, and combinations thereof.

16. The fluid storage and dispensing system of claim 13, wherein the non-metal adsorbent particles have average pore size in a range of from about 0.5 nm to about 50.0 nm.

17. The fluid storage and dispensing system of claim 1, wherein the porous metal matrix forms a solid-phase metal sorbent medium and is characterized by an average pore diameter in a range of from about $0.25\mu m$ to about $500\mu m$.

18. The fluid storage and dispensing system of claim 17, wherein the porous metal matrix is further characterized by a porosity in a range of from about 15% to about 95%, based on total volume of the porous metal matrix.

19. A method of making a porous metal matrix, including the steps of:

providing fine metal particles comprising a Group VIII or Group IB metal; and

sintering said fine metal particles to form the porous metal matrix.

20. The method of claim 19, wherein the fine metal particles have average particle size in a range of from about 20 nm to about 1.0μm.

21. The method of claim 19, wherein the fine material particles have been sintered at temperature in a range of from about 20°C to about 1500°C.

22. A method of making a porous metal matrix, including the steps of:

forming a solid-phase matrix comprising at least a Group VIII or Group IB metal and an oxidizable carbon-containing material; and

heating said solid-phase matrix in presence of an oxidizing agent to gasify said oxidizable carbon-containing material.

23. The method of claim 22, wherein the oxidizable carbon-containing material is selected from the group consisting of elemental carbons and hydrocarbon compounds.

24. The method of claim 22, wherein the oxidizable carbon-containing material is dispersed in the solid-phase matrix.

25. The method of claim 22, wherein the oxidizing agent is selected from the group consisting of elemental oxygen, oxygen gas, ozone, air, and combinations of two or more species thereof.

26. A method of making a porous metal matrix, including the steps of:

forming a solid-phase matrix comprising at least a Group VIII or Group IB metal and soluble metal oxide particles; and

immersing said solid-phase matrix in an acidic solution to dissolve said soluble metal oxide particles.

27. The method of claim 26, wherein the soluble metal oxide particles comprise at least one metal component selected from the group consisting of Fe, Ni, Ag, and Pt.

28. An adsorption-desorption apparatus, for storage and dispensing of a low vapor pressure fluid, said apparatus comprising:

a storage and dispensing vessel constructed and arranged for holding a solid-phase metal adsorbent medium;

a solid-phase metal adsorbent medium disposed in said storage and dispensing vessel at an interior gas pressure, wherein said solid-phase metal adsorbent medium includes a porous metal matrix comprising at least one Group VIII or Group IB metal;

a low vapor pressure fluid adsorbed on said solid-phase metal adsorbent medium; and

a dispensing assembly coupled in gas flow communication with the storage and dispensing vessel, and arranged for dispensing from the vessel low vapor pressure fluid desorbed from the solid-phase metal adsorbent medium.

29. The adsorption-desorption apparatus of claim 28, wherein the low vapor pressure fluid comprises a fluid species selected from the group consisting of chlorine trifluoride (ClF_3), tungsten hexafluoride (WF_6), hydrogen fluoride (HF), germanium tetrafluoride (GeF_4), and bromine (Br_2).

30. The adsorption-desorption apparatus of claim 28, wherein the porous metal matrix comprises one or more metals selected from the group consisting of iron, nickel, cobalt, ruthenium, rhodium, palladium, osmium, iridium, platinium, copper, silver, gold, and alloys thereof.

31. The adsorption-desorption apparatus of claim 28, wherein the porous metal matrix comprises nickel.

32. The adsorption-desorption apparatus of claim 28, wherein the porous metal matrix comprises stainless steel.

33. The adsorption-desorption apparatus of claim 28, wherein the porous metal matrix is characterized by an average pore diameter in a range of from about 0.5 nm to about 2.0 nm.

34. The adsorption-desorption apparatus of claim 33, wherein the porous metal matrix is characterized by porosity in a range of from about 10% to about 30% by total volume of such porous metal matrix.

35. The adsorption-desorption apparatus of claim 28, further comprising non-metal adsorbent particles dispersed in the solid-phase adsorbent medium.

36. The adsorption-desorption apparatus of claim 35, wherein the non-metal adsorbent particles comprise a material selected from the group consisting of zeolites, carbon materials, porous silicon, polymers, aluminum phosphosilicate, clays, and combinations of two or more species thereof.

37. The adsorption-desorption apparatus of claim 35, wherein the non-metal adsorbent particles comprise a material selected from the group consisting of zeolites, carbon materials, and combinations thereof.

38. The adsorption-desorption apparatus of claim 35, wherein the non-metal adsorbent particles have average particle size in a range of from about 0.5 nm to about 50.0 nm.

39. The adsorption-desorption apparatus of claim 28, further comprising non-metal adsorbent particles coated with a Group VIII metal, a Group IB metal or metal alloy thereof.

40. The adsorption-desorption apparatus of claim 39, wherein the non-metal adsorbent particles comprise a material selected from the group consisting of zeolites, carbon materials, porous silicon, polymers, aluminum phosphosilicate, clays, and combinations of two or more species thereof.

41. The adsorption-desorption apparatus of claim 39, wherein the non-metal adsorbent particles comprise a material selected from the group consisting of zeolites, carbon materials, and combinations thereof.

42. The adsorption-desorption apparatus of claim 39, wherein the non-metal adsorbent particles have average particle size in a range of from about 0.5 nm to about 50.0 nm.

43. A fluid storage and dispensing system, comprising a vessel holding a solid-phase metal adsorbent medium having a low vapor pressure fluid adsorbed thereon, said vessel including a port having dispensing means associated therewith for controllably dispensing said low vapor pressure fluid desorbed from the solid-phase metal adsorbent medium in a dispensing mode of operation of said system, wherein said solid-phase metal adsorbent medium comprises a porous metal matrix containing at least one Group VIII or Group IB metal.

44. The fluid storage and dispensing system of claim 43, wherein the porous metal matrix is characterized by an average pore diameter in a range of from about 0.5 nm to 2.0 nm.

45. The fluid storage and dispensing system of claim 44, wherein the porous metal matrix is further characterized by porosity in a range of from about 10% to about 30%, based on total volume of said porous metal matrix.

46. A fluid storage and dispensing apparatus for storage and dispensing of a low vapor pressure liquefied gas, comprising:

a storage and dispensing vessel constructed and arranged for holding a solid-phase metal sorbent medium;

a solid-phase metal sorbent medium disposed in said storage and dispensing vessel at an interior gas pressure, said solid-phase metal sorbent medium comprising a porous metal matrix including at least one Group VIII or Group IB metal;

a low vapor pressure liquefied gas sorbed by said solid-phase metal sorbent medium;

a fluid dispensing assembly coupled in gas flow communication with the storage and dispensing vessel, and arranged for dispensing from the vessel gas derived from the low vapor pressure liquefied gas; and

a double-stage fluid pressure regulator associated with the fluid dispensing assembly, and arranged to maintain a predetermined pressure in the interior volume of the vessel,

wherein the fluid dispensing assembly is selectively actuatable to flow gas, derived from the low vapor pressure liquefied gas sorbed by said solid-phase metal sorbent medium, through the double-stage fluid pressure regulator, for discharge of the gas from the vessel.

47. A fluid storage and dispensing apparatus of claim 46, wherein the porous metal matrix is characterized by an average pore diameter in a range of from about 0.25μm to about 500μm.

48. A fluid storage and dispensing apparatus of claim 47, wherein the porous metal matrix is further characterized by a porosity in a range of from about 15% to about 95%, based on total volume of the porous metal matrix.

49. A fluid storage and dispensing apparatus of claim 46, further comprising one or more heating elements for supplying thermal energy to the low vapor pressure liquefied gas to compensate for heat loss during evaporation of such low vapor pressure liquefied gas.

50. A fluid storage and dispensing apparatus of claim 49, wherein said heating elements are disposed on an external wall of the storage and dispensing vessel, and wherein the solid-phase metal sorbent medium conducts thermal energy supplied by said heating elements to the sorbed low vapor pressure liquefied gas.

51. A process for supplying a low vapor pressure fluid reagent, such process comprising:

providing a storage and dispensing vessel containing a solid-phase metal adsorbent having a sorptive affinity for said low vapor pressure fluid reagent;

sorptively adsorbing the low pressure fluid reagent on the solid-phase metal adsorbent at an interior gas pressure to yield a sorbate fluid-retaining metal adsorbent;

desorbing sorbate fluid from the sorbate fluid-retaining metal adsorbent; and

dispensing the desorbed fluid from said storage and dispensing vessel;

wherein said solid-phase metal adsorbent medium includes a porous metal matrix comprising at least one Group VIII or Group IB metal.

52. A method of supplying a low vapor pressure fluid to a process requiring same, said method comprising sorptively retaining said low vapor pressure fluid on a solid-phase metal adsorbent including a porous metal matrix comprising at least one Group VIII or Group IB metal, and desorptively removing said low vapor pressure fluid from said metal adsorbent and transporting same to said process when said process requires same.

53. The method of claim 52, wherein said step of desorptively removing said low vapor pressure fluid from said adsorbent comprises a desorption modality selected from the group consisting of pressure differential-mediated desorption, thermally-mediated desorption, and concentration differential-mediated desorption.

54. A fluid storage and dispensing system, comprising a storage and dispensing vessel for holding a low vapor pressure liquefied gas therein, a discharge assembly disposed on the vessel for dispensing low vapor pressure liquefied gas therefrom, and a gas flow regulator inside the vessel arranged for flow therethrough of gas deriving from the low vapor pressure liquefied gas, so that gas flows through the regulator prior to flow through the discharge assembly, with a body of solid-phase metal sorbent arranged in the vessel to sorptively immobilize any low vapor pressure liquefied gas that would otherwise flow

into the regulator, said solid-phase metal sorbent including a porous metal matrix comprising at least one Group VIII or Group IB metal.

55. The fluid storage and dispensing system of claim 54, wherein the regulator is coupled with a gas flow conduit inside the vessel arranged to receive gas deriving from the low vapor pressure liquefied gas, for flow of said gas through the conduit, the regulator and the discharge assembly, wherein said body of solid-phase metal sorbent is provided in said gas flow conduit, for contacting and sorbing liquid therein.

56. A method of suppressing pressure perturbations of a fluid storage and dispensing system including a storage and dispensing vessel for holding a low vapor pressure liquefied gas therein, a discharge assembly disposed on the vessel for dispensing low vapor pressure liquefied gas therefrom, and a gas flow regulator inside the vessel arranged for flow therethrough of gas deriving from the low vapor pressure liquefied gas, so that gas flows through the regulator prior to flow through the discharge assembly, wherein said pressure perturbations are occasioned by ingress of said low vapor pressure liquefied gas into the regulator, said method comprising shielding the regulator from contact with said low vapor pressure liquefied gas with a body of solid-phase metal sorbent arranged in the vessel to sorptively take up any low vapor pressure liquefied gas that would otherwise flow into the regulator, said solid-phase metal sorbent including a porous metal matrix comprising at least one Group VIII or IB metal.